

C.F.R. §§ 1.16 to 1.21 from Arnold, White & Durkee Deposit Account No. 01-2508/ADAA:105/WIM.

Reconsideration in view of the remarks contained herein is respectfully requested.

REMARKS

I. Claims in the Case

Claims 1 and 3 to 20 were under review in the Official Action (the "Action"). No claims have been amended, and thus Claims 1 and 3 to 20 are pending in the case.

II. The Rejection of Claims Under 35 U.S.C. § 103 Is Overcome

A. General Comments to Rejections Under 35 U.S.C. § 103

In assessing the prior art relied on by the Examiner, it is helpful to bear in mind that Claim 1 is directed to an electrochemical cell comprising, a combination of the following features:

- (i) As at least part of the anode, a lithium transition metal oxide compound which has a $[B_2]X_4^n$ spinel type framework structure of an $A[B_2]X_4$ spinel, etc.;
- (ii) As at least part of the cathode, a (solid) lithium metal oxide compound;
- (iii) An electrically insulative lithium containing liquid or polymeric ionically conductive electrolyte between the anode and the cathode;
- (iv) The anode, cathode and electrolyte being such that the mechanism of the cell involves, on discharge, lithium ions being extracted from the spinel type framework structure of the anode, with the oxidation state of the metal ions of the anode thereby increasing, while a concomitant insertion of lithium ions into the compound of the cathode takes place, with the oxidation state of the metal ions of the cathode decreasing correspondingly, i.e., a "rocking chair" effect is achieved. In this regard, see also page 18, lines 5 to 9 of the specification.

To make a *prima facie* case of obviousness, the Examiner must cite references that suggest the claimed invention as a whole. It is insufficient that a cited prior art reference merely discloses the components of the claimed invention, either separately or used in other

combinations; there must be some teaching, suggestion or incentive to make the combination made by the inventor in the present instance, i.e., the combination as claimed. Furthermore, there must be some reason, suggestion or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make the combination, and that knowledge must not come from the applicant's invention itself.

Additionally, the consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have a reasonable likelihood of success, viewed in the light of the prior art. Both the suggestion and the expectation of success must be found in the prior art, not in the applicant's disclosure.

The Applicants respectfully point out that not one of the references relied on by the Examiner provides a motivation for an electrochemical cell as claimed herein, and particularly as claimed in Claim 1.

B. Rejection of Claims as Obvious over Thackeray *et al.* (US 4507371)

As discussed in the response previously filed, Thackeray '371 is concerned with electrochemical cells having an anode and a cathode coupled together by a solid electrolyte, with each of the anode, cathode and electrolyte comprising a cubic close-packed framework structure having, as its base structural unit, a unit of the formula $(B_2)X_4^{n-1}$ where $(B_2)X_4$ is a structural unit of an $A(B_2)X_4$ spinel. Although the reference discloses that both the anode and cathode can be of spinel material, it deals with combinations of these components with non-spinel compounds in general fashion only. Furthermore, the only example in US 4507371 discloses a cell having a lithium anode (and not a lithium transition metal oxide spinel compound anode as claimed in the

present invention), a spinel (LiMn_2O_4) cathode and a liquid electrolyte comprising one molar LiBF_4 in propylene carbonate.

In other words, Thackeray '371 does not at all teach the combination of features (i), (ii), (iii) and (iv) of Claim 1 as set out above and in particular does not teach a cell operating in "rocking chair" fashion. As indicated in the previous response, this "rocking chair" effect occurs when lithium ions are transported between two transition metal oxide electrodes as discussed in the specification.

In the present official action, the Examiner contends, that the invention as a whole would have been obvious to one having ordinary skill in the art at the time that the invention was made because the artisan has sufficient skill to select the materials necessary for the voltage requirements needed.

The Applicants respectfully submit that this argument is not well founded. To establish a *prima facie* case of obviousness, the Examiner must provide logical reasoning or evidence to support his assumption that it would have been obvious to one of ordinary skill in the art to select the anode, cathode and electrolyte to provide a cell which operates in said "rocking chair" fashion. There is simply no teaching in Thackeray '371 of such "rocking chair" operation. In the absence of any such teaching or suggestion in Thackeray '371 no *prima facie* case for obviousness has been made.

Furthermore, it is not sufficient that the prior art discloses particular elements of the invention, i.e., an anode, a cathode and an electrolyte, but it must suggest the desirability, and thus the obviousness of making the claimed combination, i.e., the combination which results in the "rocking chair" effect. For a *prima facie* case of obviousness, the reference must thus at least suggest the combining of each of the elements in the claim to achieve the "rocking chair" effect.

The motivation to combine the elements in such manner must be found in the prior art, not in the applicant's disclosure. The Applicants respectfully submit that Thackeray '371 does not at all provide the requisite motivation to modify its teachings to recreate the instantly claimed invention.

Additionally, a finding of *prima facie* obviousness requires that the prior art reference reveals a reasonable expectation of success in producing the claimed invention, i.e., providing an electrochemical cell having an anode, cathode and electrolyte as claimed, and which co-operate to produce a cell which operates in "rocking chair" fashion. Furthermore, there must be evidence in the prior art of such reasonable expectation of success. Neither the required reasonable expectation of success nor the evidence thereof, to produce a cell operating in "rocking chair" fashion, is found in Thackeray '371.

Contrary to the Examiner's assertions, it would not have been obvious to one of ordinary skill in the art at the time the invention was made to select a combination of an anode, a cathode and an electrolyte which operate to produce a cell operating in said "rocking chair" fashion. As discussed above, there is not motivation for such a cell in Thackeray '371.

The obviousness rejection is also improper because Thackeray '371 is not analogous art. In other words, Thackeray '371 does not deal with the same problems solved by the claimed invention. As indicated in the previous response, the claimed invention is directed to providing a safe lithium cell containing no metallic lithium in the anode. In contrast, the cell exemplified in Thackeray '371 has, as hereinbefore set out, an anode of lithium metal.

It is thus respectfully submitted that the presently claimed invention is not obvious in the light of Thackeray '371, for the reasons set out above.

C. Rejection of Claims Over Thackeray et al. US 4980251

Thackeray '251 is directed to a method of synthesizing an essentially single phase lithium manganese oxide having a specified formula and having a spinel type crystal structure. The resultant compound is suitable for use as a cathode in an electrochemical cell of the Li/Li_xMnO₂ type (col 1 lines 12/13) together with an anode comprising lithium or a suitable lithium-containing alloy (col 1 lines 13/14).

Thackeray '251 thus deals in detail with the manufacture of a cathode for an electrochemical cell, and discloses only in broad outline the electrochemical cell as such and the anode therefor.

The Examiner is not correct in his statement that Thackeray '251 teaches that the spinel structure may be used for both the anode and the cathode. The passage quoted by the Examiner (col 2 lines 37 to 68) merely supports that the spinel structure can be used as a cathode in an electrochemical cell. Indeed, Thackeray '251 emphasizes that the compound in question has exceptional utility as a reversible or secondary cathode in an electrochemical cell - see col 7 line 61 to col 8 line 8. It is totally silent and does not at all suggest using the compound as an anode in an electrochemical cell. Indeed, Thackeray '251 only teaches, in relation to the anode, the use of lithium or a lithium containing alloy. It does thus not at all teach or suggest using as an anode a lithium transition metal oxide having a spinel type structure as claimed in the present invention.

This is supported by the specific examples of Thackeray '251. Figures 1 to 11 deal only with compounds, and Figures 13 to 15 relate to the use of a cell having both a cathode and an anode. The anode of the cell reflected in Figures 13 to 15 teaches the use of a metallic lithium anode (col 6 line 15). Thackeray '251 would thus not at all suggest to a person of ordinary skill in the art to use an anode as defined in Claim 1.

Furthermore, and importantly, Thackeray '251 does not at all teach the rocking chair effect which is the feature of integer (iv) of Claim 1 as set out in paragraph A.1 above, and which is crucial to the present invention as discussed above.

The Examiner's contention that the claimed invention is thus obvious over Thackeray '251 is thus entirely speculative. In particular, Thackeray '251 does not suggest the claimed invention as a whole, does not suggest or provide an incentive to make the combination as claimed in Claim 1, does not provide motivation for a person of ordinary skill in the field of the art to make the combination as claimed in Claim 1, does not suggest the desirability and thus the obviousness of making the combination of Claim 1, does not provide a reasonable expectation of success in producing the cell of Claim 1, and does not form analogous art since it specifically teaches a cell having a metallic lithium anode which is what the presently claimed invention seeks to avoid.

D. Rejections of Claims as Obvious over Thackeray (US 5316877)

Thackeray '877 deals with a cathode for an electrochemical cell with the cathode comprising an electrochemically active compound of lithium, manganese and oxygen having a spinel type structure and having a specified formula. Similarly to Thackeray '251 discussed above, this patent deals in details with the cathode of an electrochemical cell and deals only in broad outline with the other components of the cell, particularly the anode and the electrolyte.

Thus, in respect of the anode, it teaches that it may be lithium metal, a lithium aluminum alloy, etc. It is thus totally silent on the anode being a lithium transition metal oxide spinel compound as claimed in integer (i) of Claim 1 of the present case.

This is emphasized when referring to the specific examples of Thackeray '877. All the Figures, with the exception of Figure 25, relate to cathodes. Similarly, all of Examples 1 to 10

relate to the manufacture of the cathode, and refer only to the anode as being lithium. When read together with the description of Figure 25 which relates to the test cell, on page 15, it is clear that it does not teach at all the use of a spinel compound as claimed in integer (i) of Claim 1 of the present application, as an anode.

Accordingly, Thackeray '877 also does not teach at all the "rocking chair" effect of integer (iv) of Claim 1, which has as a prerequisite the spinel compound of integer (i) thereof.

It is thus respectfully submitted that this reference also does not at all teach or suggest the combination of integers (i) to (iv) of Claim 1 of the present application, as set out in A.1 above.

Thackeray '877 also does thus not suggest the claimed invention as a whole, does not suggest or provide an incentive to make the combination as claimed in Claim 1, does not provide motivation for a person of ordinary skill in the field of the art to make the combination as claimed in Claim 1, does not suggest the desirability and thus the obviousness of making the combination of Claim 1, does not provide a reasonable expectation of success in producing the cell of Claim 1, and does not form analogous art since it specifically teaches a cell having a metallic lithium anode which is what the presently claimed invention seeks to avoid.

III. Conclusion

In view of the above, Applicants submit that this case is in condition for allowance.

If the Examiner has any comments, questions, or suggestions that might speed allowance of these claims, he is earnestly requested to contact the Applicants' representative listed below.

Please date and return the enclosed postcard evidencing receipt of this paper.

Respectfully submitted,



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